ORIGINAL

BEFORE THE

Federal Communications Commission

WASHINGTON, D.C.

In the Matter of	)	
	)	
Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation	)	ET Docket 93-62

COMMENTS OF AMSC SUBSIDIARY CORPORATION

Bruce D. Jacobs
Glenn S. Richards
John J. McVeigh
Fisher, Wayland, Cooper & Leader
1255 23rd Street, N.W.
Suite 800
Washington, D.C. 20037
(202) 659-3494

Lon C. Levin
Vice President and
Regulatory Counsel
AMSC Subsidiary Corporation
1150 Connecticut Avenue, N.W.
Fourth Floor
Washington, D.C. 20036
(202) 331-5858

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Summary

AMSC Subsidiary Corporation ("AMSC"), the licensee of the U.S. Mobile Satellite Service ("MSS") system, urges the Commission in reviewing its RF exposure rules to apply an appropriate balance between the use and development of radio-frequency facilities and equipment, much of which provides tremendous public benefit, and the protection of the public from potentially harmful exposure.

AMSC takes no position on the specific adoption of the new ANSI/IEEE standard for RF exposure, but it urges the Commission, if it adopts a new standard, to retain a categorical exclusion for mobile equipment and to expand the exclusion to include MSS mobile terminals. There is no credible evidence that mobile equipment is unsafe when used in a conventional manner, and AMSC's mobile terminals are similar to other vehicle-mounted mobile equipment in their RF radiation characteristics.

Any new standard cannot be implemented without the approval of testing methodologies and test facilities. If the Commission adopts a new standard and eliminates the existing categorical exclusion or does not extend the exclusion to MSS mobile terminals, AMSC recommends that the Commission phase in the implementation of the new standard and use the current standard at least until: the Commission has established a methodology for testing compliance with the new standard; test facilities or analytical models have been established; and ready access to such standards or models exists. Given the substantial evidence that the current standard is adequate to protect the public, there is

no reason to restrict the use of mobile equipment before any new standard can be effectively implemented.

AMSC also recommends that the Commission preempt state regulation of RF exposure.

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AMSC Subsidiary Corporation ("AMSC") hereby comments on the Notice of Proposed Rule Making ("NPRM") in the instant proceeding.[1/] The NPRM proposes to amend and update the guidelines and methods used for evaluating the environmental effects of radio-frequency ("RF") radiation from FCC-regulated facilities, including the adoption of a standard for RF exposure recently promulgated by the American National Standards Institute ("ANSI") in association with the Institute of Electrical and Electronic Engineers ("IEEE").[2/]

As AMSC will state in greater detail below, it takes no position on the merits of the revised ANSI standard. Whether or not the Commission adopts C95.1-1992, however, AMSC strongly urges the FCC to categorically exclude from environmental processing applications for blanket licenses for MSS mobile terminals on the grounds that such devices pose no significant risk of exposure in excess of the permissible levels in either

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1/ 8 FCC Rcd 2849 (1993).

2/ ANSI/IEEE C95.1-1992. ANSI adopted the standard to supplant one it had promulgated ten years earlier, ANSI C95.1-1982.

the current or the proposed standards. AMSC's mobile terminals have similar characteristics, in terms of their RF radiation, as other vehicle-mounted mobile equipment.

If the Commission decides not to apply a categorical exclusion to AMSC's mobile terminals, then AMSC strongly urges the Commission to phase in the implementation of any new standard so as not to disrupt AMSC's efforts to bring Mobile Satellite Service to the American people. C95.1-1992 cannot be implemented without clear and unambiguous analytical and measurement procedures for demonstrating compliance with the new standard and there is ready access to necessary test facilities or to acceptable analytical models.

Finally, AMSC also urges the Commission to invoke the doctrine of federal preemption to forestall any state or local government action that could threaten the national communications service that AMSC will provide.

Background

AMSC is the entity licensed by the Commission to construct, launch and operate a Mobile Satellite Service ("MSS") system for the United States,[3/] a system which is scheduled to begin operation in little more than one year. The AMSC system will fill a significant void in this country's communications network, providing communications services to subscribers practically

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3/ See Memorandum Opinion, Order and Authorization ("AMSC Authorization Order"), 4 FCC Rcd 6041 (1989); Final Decision on Remand, 7 FCC Rcd 266 (1992); aff'd sub nom. Aeronautical Radio, Inc. v. FCC, 983 F.2d 275 (D.C. Cir. 1993).

anywhere in the continental United States, Alaska, Hawaii, Puerto Rico, the U.S. Virgin Islands, and 200 miles of the U.S. coast. For the first time, those living in or passing through rural and remote areas beyond the range of terrestrial communications services (e.g., cellular telephone systems) will have access to mobile communications services. For this reason, the FCC has repeatedly acknowledged the pressing need for MSS.[4/] AMSC's expeditious initiation of such service will lay the foundation for the ultimate success of the MSS industry, and will fulfill the terms of AMSC's FCC authorization.

AMSC's MSS system will initially comprise: one geosynchronous satellite; a Network Operations Center; a feeder-link earth station; and numerous (ultimately hundreds of thousands of) mobile earth terminals installed for subscribers' use in cars, trucks, buses, railroad cars, and boats.[5/] AMSC has raised over $500 million towards the construction, launch and operation of the system. Construction is well underway, with launch of the first satellite scheduled for the fourth quarter of 1994 and the commencement of operations shortly thereafter. Two

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4/ See, e.g., AMSC Authorization Order, supra; Second Report and Order, 2 FCC Rcd 485 (1987).

5/ The FCC has assigned AMSC the 1544-1559/1645.5-1660.5 MHz bands for its mobile links. AMSC's feeder links will operate at 11 and 13 GHz in Ku-band spectrum. See AMSC Authorization Order, supra; see also Memorandum Opinion and Order, 8 FCC Rcd 4040 (1993). AMSC has applications pending before the Commission to construct and operate the feeder-link earth station (File No. 445-DSE-P/L-93) and to operate up to 200,000 mobile terminals (File No. 2823-DSE-P/L-93). AMSC has asked permission to use 12- and 14-GHz bands allocated for satellite telemetry, tracking and control purposes. File No. 3-OSS-Amend-93.

large electronics manufacturers, Westinghouse Electric Corporation and Mitsubishi Electric Corporation, are constructing the mobile terminals at their own expense.

AMSC's system will employ RF radiation for signalling and control purposes, and for transmissions of voice and data. There will be various types of mobile terminals. Some will function only in the L-band and only for MSS data or voice communications. Others will combine an L-band MSS transceiver and a conventional UHF cellular telephone in one enclosure and with one handset.[6/] Mobile terminals will function with different antennas, including a medium-gain collinear mast antenna, a medium-gain disc antenna, and high-gain disc and parabolic-reflector antennas for specialized applications. Because line-of-sight to the satellite is important to consistent communications, mobile-terminal antennas will be mounted on unobstructed surfaces such as vehicle roofs and trunk lids. These mobile terminals have low transmitter and radiated-power levels, akin to or even lower than those of mobile transmitters operating under Parts 21, 22, 23, 90, and 94 of the Rules.[7/] AMSC expects mobile terminals to have suggested retail prices of approximately $2,000.

Use of the electromagnetic spectrum has revolutionized daily life. In many ways, our modern civilization could not function without using the spectrum: for radio communications; in

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6/ Users will select from between the two operating modes as they move in and out of terrestrial systems' service areas.

7/ See Exhibit A, the Engineering Statement of Charles Kittiver, AMSC's Microwave Systems Engineer (attached).

industrial processes; and in medical diagnosis and treatment. The electromagnetic spectrum is clearly one of our most important natural resources, and the efficient, orderly continued development of that resource will be essential to further social and economic advances.

Here is just a sampling of vital societal functions that heavily depend on RF communications -- especially involving mobile units -- for their effectiveness:

- law enforcement and drug interdiction;
- firefighting and cleanups of toxic-chemical spills;
- emergency medical and vehicle-repair services;
- gathering of news, and of vital weather and safety information, especially during disasters;
- air-traffic control; and
- mass transit systems, railroads, and interstate bus and truck fleets.

People will use MSS for each of these functions. Law-enforcement and drug-enforcement personnel will coordinate their field activities via MSS when outside the range of terrestrial communications networks. Firefighters and toxic-cleanup crews will use MSS to communicate with each other and their home bases when deployed in remote areas. One can easily foresee MSS communications saving lives by allowing emergency-medical and road-repair personnel to reach ill or stranded people in remote areas and, in more developed regions, when natural disasters disrupt traditional communications infrastructures. People will also use MSS to gather news, weather information, air-traffic data, and to control rail, bus, and truck fleets.

The role of radio communications will surely continue to grow, as digital computers become more portable and more powerful. We will continue to move away from paper and ink and toward electronic means as our primary means of exchanging information. This trend will render prevalent -- even commonplace -- what are today extremely sophisticated radio communications. MSS will play an important role in this development, enabling people to conduct such sophisticated communications from almost anywhere. MSS will clearly be a key component of the new national information highway, whose development is so important to this nation's continued prosperity and economic development.

The success of this endeavor will depend in large part on the ready availability to the public of mobile terminals technically compatible with AMSC's system, and on the attitude of the public toward such equipment. The Commission's actions in this proceeding will have significant effects on both factors.

Early last year, a public uproar ensued after reports of a Florida lawsuit that alleged a woman's fatal brain cancer resulted from her frequent use of a handheld cellular telephone. Although the "panic" was short-lived, it should drive home the point that there is a great public sensitivity on the issue.[8/]

8/ To the general public, the very word "radiation" conjures up images of Three Mile Island, Chernobyl, and cancer victims. The Commission should emphasize that such associations are unfounded scientifically as far as RF is concerned. Radiation is simply energy emitted in the form of waves or particles. It is not synonymous with "radioactivity." Radioactivity is but one form of radiation. Most are

(continued...)

Therefore, the FCC should use this rule making as an opportunity to reemphasize that exposures to low and even moderate levels of RF radiation pose no demonstrable risk to public health.[9/]

8/(...continued)
innocuous -- such as moonlight, the warmth emitted by a fireplace, or the sound of a chirping bird.

9/ The FCC's informational bulletin OET No. 56, Questions and Answers about Biological Effects and Potential Hazards of Radiofrequency Radiation ([date]), makes it clear that, although intense RF fields can cause harm by rapid tissue heating, no clear evidence exists that weak fields have any harmful effects. The same bulletin states at pp. 12-13:

> In general, there is no evidence that there is any safety hazard associated with RF exposure from vehicle-mounted antennas.... [I]f hand-held radios are used properly there is no evidence that they could cause hazardous absorption of [RF] energy.

And the National Council on Radiation Protection and Measurements' ("NCRPM") Report No. 86, Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields ([date]), states at p. 46:

> There is no well-documented evidence that exposure to [RF] radiation increases the risk of cancer in human beings or in experimental animals. The few instances in which it has been alleged that low-intensity fields are carcinogenic have not been substantiated....

C95.1-1992 itself observes:

The members of Subcommittee IV believe that the recommended exposure levels should be safe for all, and submit as support for this conclusion the observation that no reliable scientific data exist indicating that:

(1) Certain subgroups of the population are more at risk than others

(2) Exposure duration at ANSI C95.1-1982 levels is a significant risk

(3) Damage from exposure to electromagnetic fields is cumulative, or

(continued...)

Discussion

AMSC urges the Commission to act conservatively to protect the public, but at the same time not to act unreasonably to restrict the beneficial use of RF energy. The latter would entail great actual and potential costs to society -- with no reliable claim to any benefit. Countless tens of millions of person-hours of low-level RF exposure have accrued since the dawn of radio communications, to all appearances without any adverse consequences. Surely that experience militates in favor of prudent restraint in the establishment of any new restrictions.

AMSC is not expert in the area of the bioeffects of RF, so AMSC does take a position on the merits of supplanting C95.1-1982 with C95.1-1992. [10/] From AMSC's perspective, regardless of

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9/(...continued)

> (4) Nonthermal (other than shock) or modulation-specific sequelae [after-effects] of exposure may be meaningfully related to human health.
>
> C95.1-1992 also states that there are "[n]o verified reports of injury to human beings or of adverse effects on the health of human beings who have been exposed to electromagnetic fields within the limits of frequency and SAR specified by... ANSI C95.1-1982...."

10/ AMSC recommends that the Commission extrapolate any low-power exclusion from the current upper frequency limit of 1.5 GHz to apply to mobile terminals operating at 1.6 GHz. AMSC's current generation of mobile terminals has an RF antenna input power of 3 or 4 watts, so the exclusion would not apply. Notwithstanding this, future generations of MSS mobile terminals may operate at power levels consistent with the exclusion, provided it is extrapolated linearly above 1500 MHz. AMSC urges such extrapolation, up to at least 6 GHz, because the current cutoff of 1.5 GHz appears to be arbitrary; C95.1-1992 states that such exclusions are appropriate where exposures are quasi-optical; and the

(continued...)

whether the FCC continues to employ C95.1-1982 or supplants it with C95.1-1992, the real issues are: whether the FCC should continue categorical exclusions of certain classes of equipment; how the FCC should implement any new RF exposure standard; and whether there should be a single, national standard. What follows presents AMSC's views on these subjects.

I. The FCC Should Continue And Expand Its Categorical Exclusions

When it last addressed the issue of RF exposure, the Commission categorically excluded from RF-exposure analysis all facilities that would function under most parts of the FCC rules.[11/] Only facilities in the Broadcast Service (Part 73), Broadcast Auxiliary Service (Part 74), and the Satellite Radio Service (Part 25) are scrutinized for compliance with C95.1-1982. The Commission based its decision on two factors. The first is its power under National Environmental Policy Act of 1969 as amended, 42 U.S.C. § 4321 et seq. ("NEPA") to categorically exclude from environmental consideration those proposals which entailed only a very remote possibility of environmental consequences. The second is an exhaustive record of the exposure potential of many types of radio equipment, especially mobile

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10/(...continued)
standard describes exposures at up to 6 GHz as quasi-optical. AMSC also urges that the Commission clarify that the IEEE Dictionary's definition of "radiated power" is the relevant concept for the purposes of the exclusion, as that appears to have been the IEEE's intent.

11/ Second Report and Order in General Docket No. 79-144, 2 FCC Rcd 2064 (1987), Erratum, 2 FCC Rcd 2526 (1987).

transceivers. The FCC wisely decided that, while there was a remote, hypothetical possibility that such equipment could cause exposures in excess of the ANSI standard, such exposure would require uses of the equipment or the positioning of persons very differently from virtually any conceivable configuration that would occur in real life. See Second Report and Order, especially at Appendix C.[12/]

The ensuing six years have not undermined the validity of the Commission's prior conclusions in this regard. Nothing has changed to question the finding that use of mobile communications equipment as intended poses virtually no risk of excess exposure, even under the revised ANSI standard. The fundamentals of human ergonomics and of radio-equipment design militate against any real possibility that excess exposure will occur. Therefore, the existing categorical exclusions by FCC Rule Part remain fully valid, and there is no legitimate basis to change them, regardless of whether the Commission supplants ANSI C95.1-1982.

The FCC should also expand the existing categorical exclusion to include MSS mobile terminals subject to blanket licensing under Part 25, which are not literally covered by the current categorical exclusion. That exclusion, found at Note 1

12/ One must also keep in mind that even C95.1-1982 is very conservative. Its exposure limit is substantially below the level at which measurable warming of living tissue occurs. C95.1-1992 at 22-23. So even a rare exposure in excess of the standard due to a highly unusual configuration of equipment and user or bystander poses an infinitesimal risk of actual physical harm. Such small probabilities of actual harm justify the continuation of the existing categorical exclusion.

to § 1.1307(b) of the Rules, clearly intends to subject Part 25 applications for fixed and portable earth stations to environmental scrutiny due to their high EIRP levels and risk of significant RF exposure. However, as described above and in Exhibit A, MSS mobile earth terminals have low transmitter and radiated-power levels, similar to or lower than those used by many ground-based mobile communications systems, all of which are categorically excluded. Such strong correlation mandates similar treatment of MSS mobile earth terminals. Melody Music Inc. v. FCC, 345 F.2d 730 (D.C. Cir. 1965).

II. If the FCC Adopts the Revised ANSI Standard, It Also Should Adopt a Specific SAR Measurement Technique and Provide Adequate Time for the Establishment of Measurement Facilities

The Commission must not abruptly impose any revised RF exposure standard. The ANSI standard is not a comprehensive standard that permits equipment manufacturers and system operators to know whether they are in compliance. Instead, it is only the first step in what must be a more comprehensive process of developing appropriate measurement procedures. Until that more comprehensive program is in place and test facilities have been developed, the Commission cannot effectively implement any new standard.

C95.1-1992 specifies permissible levels of exposure first in terms of Maximum Permissible Exposures ("MPE") -- power flux densities or field strengths, averaged over appropriate periods

-- and then, if the exposure exceeds the pertinent MPE, the standard considers whether the Specific Absorption Rate ("SAR") exceeds a specific value. Test equipment and facilities are commercially available for measuring far-field power flux densities and field strengths, but no equipment or FCC-recognized test facilities are currently commercially available for measuring SARs. Only custom devices and test facilities can attempt to do so, but since the ANSI standard also does not specify a precise method for determining SAR, any use of even these devices and facilities would be inconclusive as to compliance with the standard. Thus, if the Commission adopts C95.1-1992, it cannot implement the standard until a specific measurement technique is in place, and testing facilities have been available to manufacturers and others on a nondiscriminatory basis for at least two years. Otherwise, applicants for equipment authorizations will face intolerable delays in bringing new products to market.

Underlying the implementation of any new standard should be a recognition by the Commission that there is no evidence that the exposure levels set by the current standard are inadequate to protect the public.[13/] Thus, it is reasonable for the Commission to continue applying the current standard while it lays the groundwork for implementing any new standard.

13/ The ANSI explicitly recognized the absence of any evidence of adverse effects to people from exposure to RF within the limits of the current standard. See notes 9 and 11, above.

Similarly, the Commission should show restraint in applying any new standard to existing facilities and equipment. In 1985, when the Commission adopted C95.1-1982, it determined that it is "legally obligated under NEPA to include license renewal and facility-modification applications within the scope of [its] environmental processing guidelines. Report and Order in Docket 79-144, 100 FCC 2d 543 (1985) at para. 29. The FCC therefore required applicants seeking renewals of their licenses for existing facilities as part of their renewal applications to certify compliance with the then newly-adopted standard. In essence, the FCC phased in the applicability of the 1982 standard with the next FCC license renewal cycle. The Commission continued to process applications for new or modified facilities under the environmental rules in effect on the date of filing. The Commission should follow that same approach if it adopts C95.1-1992. With regard to equipment authorizations, there is no renewal cycle. Once granted, an equipment authorization is valid for the life of the equipment, assuming no impermissible modifications to the equipment. Since mobile equipment typically lasts for only a few years, however, there is no reason to require any showing of compliance with any new standard, particularly where, as here, there is no evidence that the standard in effect at the time of any authorization inadequately protects the public.[14/]

14/ The FCC's obligations under NEPA are triggered only when the agency contemplates taking a "major Federal action." Report and Order in Docket 79-144 at para. 30. There is no legal (continued...)

III. The Commission Should Preempt Any State and Local Efforts to Regulate RF Exposure Standards

In the Report and Order in Gen. Docket 79-144, supra, the Commission declined to preempt state and local regulation of RF exposure on the grounds that:

> ... we do not believe it necessary at this time to resolve the issue of federal preemption of state and local [RF] radiation standards. Should non-federal [RF] radiation standards be adopted, adversely affecting a licensee's ability to engage in Commission-authorized activities, the Commission will not hesitate to consider this matter at that time.

AMSC urges the Commission to revisit this issue, if not in this proceeding, then in a further one. Based on the national scope of AMSC's service, a unified, national RF exposure standard is essential. The potential disruptive effects of an unduly restrictive standard could devastate MSS's prospects for success. To assure no disruption to the infant industry, AMSC urges preemption, at least in the L-band.[15/]

14/(...continued)
need to require revalidation of outstanding grants of certification or type acceptance. "The procedural requirements of the statute... are not applicable to, or triggered by, existing facilities...." Id.

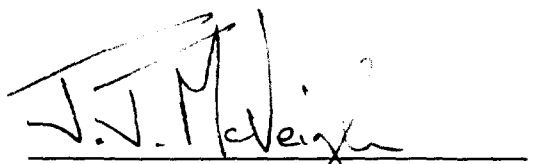
15/ The Commission has already preempted state regulation of the technical standards of the MSS space segment on the grounds that permitting 50 states to impose their individual regulatory schemes over the space-station licensee not only would be impractical but would render implementation of an MSS system virtually impossible. Second Report and Order, 2 FCC Rcd 485 (1987) at para. 40.

Conclusion

For the reasons set forth above, AMSC urges the Commission to adopt rules that are consistent with these Comments.

Respectfully submitted,

AMSC SUBSIDIARY CORPORATION



Bruce D. Jacobs
Glenn S. Richards
John J. McVeigh
Fisher, Wayland, Cooper
and Leader
1255 23rd Street, N.W.
Washington, DC 20037-1170
(202) 659-3494

Lon C. Levin
Vice President and
Regulatory Counsel
AMSC Subsidiary Corporation
10802 Park Ridge Blvd.
Reston, VA 22091
(703) 758-6000

Date: January 25, 1994

EXHIBIT A

TECHNICAL STATEMENT OF CHARLES KITTIVER

I am a Microwave Systems Engineer at American Mobile Satellite Corporation. I hold a B.E.E. degree from The Cooper Union (New York, New York) and an M.S.E.E. degree from the Newark College of Engineering (Newark, New Jersey, now called the New Jersey Institute of Technology). I have 35 years experience in the design of microwave communications systems.

As I will discuss in detail below, in connection with AMSC's Comments in ET Docket No. 93-62, AMSC has commissioned calculations to examine the RF-exposure potential of the mobile terminals to be used in conjunction with AMSC's Mobile Satellite Service ("MSS") communications system. Those calculations indicate that, in normal and customary use, the mobile terminals will comply with the exposure limits of IEEE/ANSI C95.1-1992. Moreover, the calculations indicate that RF-exposure levels from MSS terminals will be comparable to or less than the exposure levels that result from vehicle-mounted mobile communications equipment in widespread use.

AMSC has had performed theoretical analyses of three of the antennas likely to be used in AMSC's system: the MAST; the DISK; and the HELIX. The MAST and DISK are designed for mounting on various kinds of motor vehicles (e.g, passenger cars, vans, small and large trucks). The HELIX antenna has more gain than the MAST or the DISK. The HELIX will typically find itself in fixed applications (e.g., for rural telephony), mounted on roofs to provide maximum terrain and vegetation clearance. The HELIX can also be used with a transportable terminal, with the HELIX on a tripod or other portable stable platform.

The MAST antenna is about 34" high and about 1/2" in diameter. It is designed to be installed like an AM/FM car-radio whip antenna. However, the MAST will more likely mount on the lip of the trunk lid than on a front fender as is typical for AM/FM receiving

antennas. A typical installation would be along the side of the trunk adjacent to the rear fender, or along the front lip of the trunk where it pivots out from the car chassis. Figures 1 & 2 illustrate these types of antenna mounting using a mechanical mock-up of the MAST antenna. The MAST antenna will require about 3 to 4 watts of RF input power to meet the EIRP (Effective Isotropic Radiated Power) AMSC's system requires.

The DISK is about 15" in diameter and about 1" high and is designed for mounting in the middle of the car roof. This antenna could also be mounted on top of the trunk lid along the center axis of the car. Figures 3 & 4 illustrate typical mountings of the DISK on a passenger car using an antenna mock-up. Like the MAST antenna, the DISK will require about 3 to 4 watts of RF input power to generate the required EIRP.

The HELIX antenna is about 15" long and 2.5"in diameter. This antenna is designed to be installed with its long axis always pointing towards the satellite. Since the HELIX can be pointed more accurately towards the satellite, its gain can be higher (and its beam narrower) than those of the other mobile antennas. The increased gain reduces the RF input power required to 1 to 3 watts.

The following Table lists the power densities in mw/cm^2 that will result from the MAST, DISK, and HELIX antenna designs.

TABLE 1 - TABLE OF POWER DENSITIES

Distance From Antenna (inches)	POWER DENSITY (mw/cm^2)		
	MAST	DISK	HELIX
1	13.4	2.7	1.1
5	0.8	0.8	0.7
10	0.4	0.3	0.4

I derived Table 1 using data from computer models of these antenna types. Seavey Engineering Associates, Inc. of Cohasset, Massachusetts developed the mathematical models and employed the Mini Numerical Electromagnetic Code, frequently called the MiniNEC code, the industry-standard algorithm for theoretical analyses of antenna performance.[1] The Table reflects use of an RF input power of 4 watts for the MAST and DISK and 3 watts for the HELIX, and an excitation frequency of 1642 MHz. The Table indicates that more than 5 inches from the antenna, the power densities are below 0.8 mw/cm^2, which complies with the IEEE/ANSI C95.1-1992's maximum permissible exposure (MPE) of 1.1 mw/cm^2 in uncontrolled settings. Actual measurements of the MAST's output correlate well with the predicted values.

Table 1 shows that the terminals will not exceed IEEE/ANSI C95.1-1992'sMPE limits even when the subject is extremely close to the antennas (about five inches for the MAST and DISK, and only one inch from the HELIX). Furthermore, Table 1 does not take into

[1] The antennas modelled represent typical designs. In practice, actual antenna parameters may vary in some respects. However, the Table's values can be considered representative of what will result in practice.

account exposure reductions that will result from very typical transmitter duty cycles of less than 100%.

Transmissions from the mobile terminals will be voice activated to maximize satellite capacity. With a typical voice-activity factor of 40% (accounting for times when the other party is speaking and for pauses in the conversation), the resulting MPEs will be reduced by a factor of 40%.[2] Thus, I estimate that when voice activity is properly accounted for, the mobile terminals will cause MPEs well below those C95.1-1992 permits -- except in extremely rare circumstances. The calculations indicate that excess exposure would only occur if the subject constantly remains within two to three inches of the antenna for the full duration of a half-hour telephone call through MSS circuits. Such extreme and protracted proximity is highly unlikely.

To provide some basis for comparison with other services, I used the same analytical model to estimate the power densities of other mobile services already in service. Table 2 below shows the results of this comparative analysis

TABLE 2 - COMPARATIVE TABLE OF POWER DENSITY

Distance From Antenna (inches)	POWER DENSITY (mw/cm^2)		
	MAST	DISK	3-Watt Mobile Cellular Phone
5	0.8	0.8	1.6
10	0.4	0.3	0.4

NOTES:

1. MAST and DISK antennas driven by 4 watts @ 1642 MHz
2. Typical Cellular antenna driven by 3 watts @ 875 MHz
3. Data derived from MiniNEC

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[2] Actually, peak power densities are not reduced, but since IEEE/ANSI C95.1-1992 allows for a 30-minute averaging time for exposures in the uncontrolled environment, the average MPE will in fact reduce by this 40% factor.

Seavey Engineering Associates, Inc. also modelled the 3-watt mobile cellular phone antenna and used the MiniNEC code. The cellular antenna modelled was one commonly used on passenger vehicles today. Table 2 shows that the power densities of AMSC mobile terminals is comparable to the power densities of the existing 3-watt cellular unit at separation distances of 5 inches or greater. (Also, note that the MPE levels for 875-MHz cellular service frequency is approximately 0.5 mw/cm^2, about one-half the MPE value at AMSC operating frequencies.

In conclusion, there is very little likelihood that AMSC mobile terminals will cause any excess exposure when judged according to IEEE/ANSI C95.1-1992, even in uncontrolled environments.

Also, I have reviewed AMSC's Comments in this proceeding and, other than matters subject to official notice, the assertions in these Comments are true to the best of my personal knowledge, information and belief, under penalty of perjury.

Charles Kittiver

Date: January 25, 1994